2014 NORTHWEST TERRITORIES
energy charrette

CHARRETTE
FINAL REPORT

NOVEMBER 3 | EXPLORER HOTEL, YELLOWKNIFE

NOVEMBER 4 | CHIEF DRYGEESE CENTRE, DETTAH

Energy Solutions
In the Northwest Territories

ARCTIC ENERGY ALLIANCE

NT ENERGY
Pursuing our Potential

Northwest Territories

hwtac
NWT Association of Communities

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The GNWT will be releasing a response to this report in March 2015. If you would like to provide some additional input for the GNWT to consider in the development of their response, please do so on or before February 2, 2015, by sending your comments to **nwtenergy@gov.nt.ca.**

All photos by: Pat Kane

EXECUTIVE SUMMARY

In 2012, the Government of the Northwest Territories (GNWT) organized the first NWT Energy Charrette to bring together NWT representatives and energy experts to discuss the territory's energy issues and identify solutions. The GNWT used the results from the 2012 Charrette to inform the development of the NWT Energy Action Plan and the NWT Power Corporation used the input to help prepare the NWT Power System Plan, both of which were released in 2013.

Two recent developments, involving the estimated capital cost of implementing the NWT Power System Plan and an extreme low-water situation on the Snare River hydro-electric system, have led the GNWT to re-consider what else it could, or should, be doing to make the NWT's energy systems more affordable and sustainable in the long term.

The 2014 NWT Energy Charrette was organized in two parts: a public event was held the evening of Monday, November 3rd in Yellowknife, and an invitational stakeholder meeting was held in Dettah on Tuesday, November 4th. Over 200 people attended the public event and approximately 100 representatives and energy experts participated in the stakeholder meeting. The results of these discussions are presented in the following report.

For clarity, it should be noted that the Charrette facilitators (i.e. the main facilitator and the seven group facilitators) worked collaboratively to prepare this Report. As such, this Report is not an official GNWT document; rather it is a summary of the results of an interactive engagement process involving NWT stakeholders, energy experts and GNWT officials.

The 2014 Charrette featured twenty (20) different speakers or presenters – seven during the public event and fourteen during the stakeholder's meeting. Premier Bob McLeod provided some opening remarks on the NWT's energy challenges and outlined what the GNWT hoped to accomplish through the 2014 Energy Charrette. Minister Michael Miltenberger expanded upon the Premier's comments and posed a series of questions about how the GNWT should respond to the various energy concerns and pressures facing the NWT.

The keynote speaker, Dr. Marlo Raynolds, PhD., provided an overview of emerging and proven technologies that can be applied in the north. In particular, he noted that options like energy efficient products, photo-voltaic panels and wind turbines have all demonstrated rapid improvements in technology, market availability and very significant decreases in cost.

Other presenters spoke about various aspects of the economics of the electricity and space heating markets in the NWT and stressed the role that energy efficiency and renewable energy technologies can play to make the NWT's energy systems more affordable and sustainable in the long term.

During the afternoon of the Stakeholder Session, the participants were organized into seven groups, each led by a facilitator, to discuss what they had heard during the Charrette, discuss energy planning objectives, and to identify potential short and long-term actions for the GNWT to pursue.

Overall, the key results from the 2014 Charrette included:

Ranking of Energy Objectives

The groups were asked to indicate which of the energy planning objectives they felt were most important. There was a general sentiment that all the objectives were important, and that investments in energy projects or initiatives should strive to satisfy as many objectives as possible.

Overall, "Affordability" was considered the most important objective – five groups (out of seven) ranked it first. Three other objectives "Environment", "Economy" and "Energy security" were ranked fairly closely together, being second, third and fourth in roughly the same number of groups.

Short Term Actions

The short term was defined as actions that are "implementable" in a few months. As such, these are actions that could be added to the third year of the Energy Action Plan (i.e. for fiscal year 2015-16). Consensus recommendations included:

- Be more aggressive on energy efficiency and conservation – with a particular focus on program delivery / support in the thermal communities;
- Find ways to make use of the excess electrical energy available in the Taltson hydro-electric grid;
- Continue to build on biomass energy efforts – including increased financial assistance and/or technical support for the installation of biomass heating systems and the development of a biomass combined heat-and-power project;
- Plan for the increased deployment of small-scale renewable energy projects; and,
- Examine the potential benefits of increased private sector and community involvement, and investment, in energy projects.

Longer Term Actions

The longer term was defined as actions that could be considered by the 18th Legislative Assembly and implemented in the next 2-5 years. Consensus recommendations included:

- Implement an NWT Energy Efficiency Act (if not addressed in the short-term);
- Continue to consider community-scale and regional energy supply projects, where economically feasible. Specific ideas included small hydro, transmission line build-outs, district energy systems (using waste heat recovery and biomass combined heat and power (CHP)), development of natural gas and/or LNG supplies and small-scale biomass and solar projects for thermal communities; and,
- Rationalize GNWT energy policy and planning by making use of clearly defined objectives and priorities and incorporate a "portfolio" approach that uses multiple scales (community vs. regional vs. territorial, thermal vs. hydro zones) and multiple energy sources and technologies.

Next steps include soliciting additional public input on the contents of this Report, and energy issues in general, followed by a GNWT Response to this Report.

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1. INTRODUCTION

The Northwest Territories (NWT) continues to face many challenging issues regarding the development, generation and use of energy. The NWT has a tremendous supply of energy resources yet remains heavily dependent on imported fuels. As a result, the cost of energy in the NWT's communities is very expensive, contributing significantly to the high cost of living.

The NWT is also witnessing the serious impact of global energy use on our environment. Average temperatures are increasing, and climate change-related impacts are already being felt in northern communities.

The GNWT held its first NWT Energy Charrette (in November 2012) to gather input on the development of the NWT Energy Action Plan and NWT Power System Plan. Released in 2013, the Energy Action Plan is a detailed, $31 million plan for GNWT investment in energy programs and projects through to the end of 2015-16 – and the end of the mandate for the 17th Legislative Assembly. The Power System Plan presented a long-term vision for the development of the NWT electricity system, including the potential build-out of the NWT transmission grid.

Since the release of the two plans, two key circumstances have changed. First, technical work on the potential transmission line build-out revealed that the cost (well over $1 billion) is beyond the financial capacity of the GNWT. Secondly, electricity costs have continued to escalate – in part due to extreme low water conditions on the Snare River hydro-electric system. To avoid a potential 13% increase in electricity rates, the GNWT took the extraordinary step of committing $20 million in funding to cover the cost of additional diesel generation in 2014-15.

In light of these recent developments, the GNWT has recognized that it needs to re-calibrate its plans, as the current approach to energy, including the provision of substantial subsidies, is simply not sustainable in the long term. This led to the 2014 Energy Charrette, held November 3-4, 2014.

1.1. Purpose and Objectives

The purpose of the 2014 Energy Charrette was to engage with the public, stakeholders and experts to discuss the NWT's current energy challenges and propose solutions.

The Charrette activities were organized to meet several specific objectives:

A) To identify and discuss potential short-term actions that could be considered for inclusion in a revised NWT Energy Action Plan;

B) To identify and discuss potential long-term actions that could be considered for implementation by the 18th Legislative Assembly; and,

C) To demonstrate the government's commitment to working with northerners on shared concerns about the NWT's energy use now and into the future.

The Charrette agenda is available in Appendix A.

1.2. Intent of the Charrette Report

For clarity, it should be noted that the Charrette facilitators (i.e. the main facilitator and the seven group facilitators) worked collaboratively to prepare this Report.

As such, this Report is not an official GNWT document; rather it is a summary of the results of an interactive engagement process involving NWT stakeholders, energy experts and GNWT officials.

It is anticipated that the GNWT will provide its response to the 2014 Charrette in early 2015. More information on next steps is provided in Section 5.

"The GNWT is committed to change where it is required. We are currently in the second year of our three year energy plan, but if we need to change next year - 2015-16 - our government will commit to doing that."

- Premier McLeod, opening remarks, NWT Energy Charrette

2. BACKGROUND

2.1. 2012 NWT Energy Charrette

The first NWT Energy Charrette was held in Yellowknife in November 2012. It was kicked off with a public event during the evening, followed by a three-day meeting attended by approximately 125 NWT representatives and energy experts.

The format for the Charrette involved the provision of background information followed by four different facilitated discussions in breakout groups. Overall, the 2012 Charrette focused substantially on larger energy investments such as hydro-electric development, a build-out of the electric transmission grid and the increased use of natural gas, liquefied natural gas (LNG) and biomass.

The 2012 Charrette Report is available online at www.iti.gov.nt.ca/energy.

2.2. NWT Energy Action Plan

As noted earlier, the GNWT used the ideas from the 2012 Charrette to help guide the development of the current NWT Energy Action Plan, which was released in 2013 (also available at www.iti.gov.nt.ca/energy).

The Energy Action Plan represents an investment of just over $31 million in energy programs, projects and policies over three fiscal years (i.e. 2013-14 to 2015-16). The GNWT committed to complete thirty-three (33) actions grouped into four main areas:

- Energy Conservation and Efficiency;
- Energy Supply;
- GNWT Leadership; and,
- Policy and Planning.

The 33 actions were intended to address six (6) specific Energy Objectives. These included the five objectives identified during the 2012 Charrette plus an additional objective related to the optimal use of government resources.

FY2014/15 is the second year of the current Energy Action Plan.

The Honourable David Ramsay, Minister of Industry, Tourism and Investment

Some of the specific results that the GNWT has accomplished to date (as summarized by Premier McLeod during the 2014 Energy Charrette) include:

- Improving energy efficiency efforts by increasing the funding provided to the Arctic Energy Alliance for delivery of its energy efficiency programs, including the establishment of additional regional offices;
- Continuing efforts to install residential, commercial and institutional wood pellet furnaces and boilers for heating. The NWT leads the country in the use of biomass heating systems, which has spurred the development of a new biomass industry in the NWT;
- Implementation of a cutting edge solar-diesel hybrid system in Colville Lake which is backed up by battery storage. Once operational, the system will be able to supply the community's entire electricity requirements during the summer, enabling the diesel engines to be turned off for periods of time;
- Installation (in 2013) of the first Arctic liquefied natural gas (LNG) storage facility in North America, which supplies LNG for the generation of power in Inuvik.

2.3. 2014 Energy Charrette Activities

The 2014 Charrette was organized in two parts and held in Yellowknife and Dettah.

2.3.1. Public Kick-off Event – Yellowknife

The first part of the Charrette was a public kick-off event held at the Explorer Hotel on the evening of Monday, November 3rd.

After welcoming remarks from a representative of the Yellowknives Dene First Nation, Premier Bob McLeod provided some opening remarks on the NWT's energy challenges, summarized some of the actions the GNWT has already taken, and outlined what the GNWT hoped to accomplish through the 2014 Energy Charrette.

Minister Michael Miltenberger expanded upon the Premier's comments and posed a series of questions about how the GNWT should respond to the various energy concerns and pressures facing the NWT.

The keynote speaker, Dr. Marlo Raynolds, PhD., provided an overview of emerging and proven technologies that can be applied in the north. In particular, he noted that options like energy efficient appliances and other products, photo-voltaic panels and wind turbines have all demonstrated rapid improvements in technology, market availability and very significant decreases in cost.

The event ended with a moderated panel discussion about the NWT's energy challenges, and options available to address the public's concerns about rising energy costs. After each of the four panel members made some opening comments, the moderator opened the discussion to audience members' comments and questions.

2.3.2. Stakeholder Session – Dettah

The second part of the Charrette was an invitational stakeholder session held in the Chief Drygeese Conference Centre in Dettah on Tuesday, November 4th.

The morning started with a presentation on the economics of energy in the NWT and was followed by three panels focused on the following topics:

- *Panel 1:* Long Term Energy Options for the NWT
- *Panel 2:* Northern Experience with Local, Renewable and Alternative Energy Solutions
- *Panel 3:* Overview of the Energy Plan and a Focus on Energy Conservation and Efficiency

In the afternoon, participants were organized into seven breakout groups to discuss energy objectives, and short-term and long-term energy actions that could be recommended to the GNWT.

At the conclusion of the breakout group discussions, the ideas put forth by each group were presented to the main group, after which participants were invited to comment on the main themes observed during the Charrette.

2.3.3. Charrette Participants

Over 200 people attended the public event on November 3rd which lasted from 7:00 to 9:45 pm.

Approximately 100 people attended the stakeholder session on November 4th which lasted from 8:30 am to 4:30 pm. A list of represented organizations in the stakeholder session is available in Appendix B.

Rob Marshall, R. Marshall and Associates

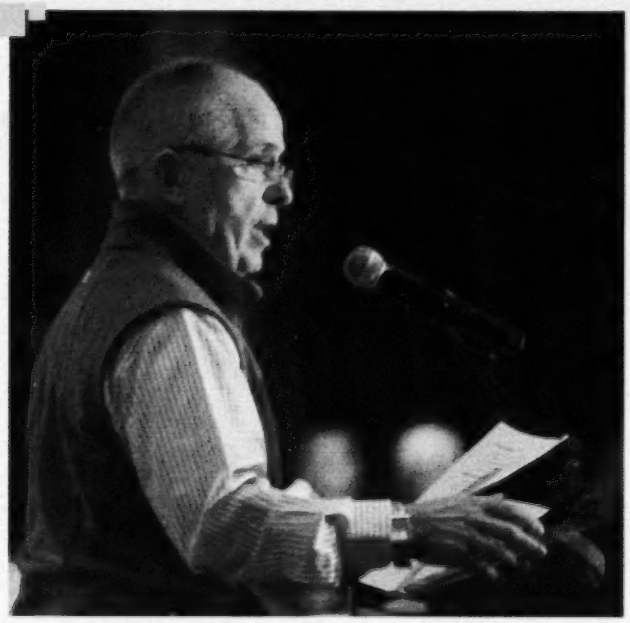
3. CHARRETTE RESULTS

This section provides a summary of the issues and ideas that were raised and discussed during the Charrette. In capturing and summarizing these results, there has been no attempt to interpret or analyze the ideas provided by the various presenters and the participants.

3.1. Presenters' Key Points and Observations

The 2014 Charrette featured twenty (20) different speakers or presenters – seven during the public event and fourteen during the stakeholder's meeting. This information provided valuable context for the discussions held during the Charrette. Copies of the various presentations are available on-line at http://www.iti.gov.nt.ca/infopage/energy-charrette-information (follow the link to Charrette Presentations).

During the public event on November 3rd, Minister Michael Miltenberger posed a series of questions regarding longer-term energy supply options and "big" electricity sector policy questions involving rate design, the role and ownership model for the NWT Power Corporation (NTPC), the role of other electric utility companies, the role of the NWT Public Utilities Board, as well as questions about the type of legislation and regulation needed to better support the use of alternative energy like biomass, solar and wind. Minister Miltenberger emphasized that in light of the current challenges, all options for system reform should be considered.



"Given the large amount of GNWT subsidies to the Northwest Territories Power Corporation, is it time to shift to a one rate zone? Is NTPC properly structured as a utility in the 21st century?"

- Minister
J. Michael Miltenberger,
Minister Responsible for the Northwest Territories Power Corporation,
Opening Remarks,
NWT Energy Charrette

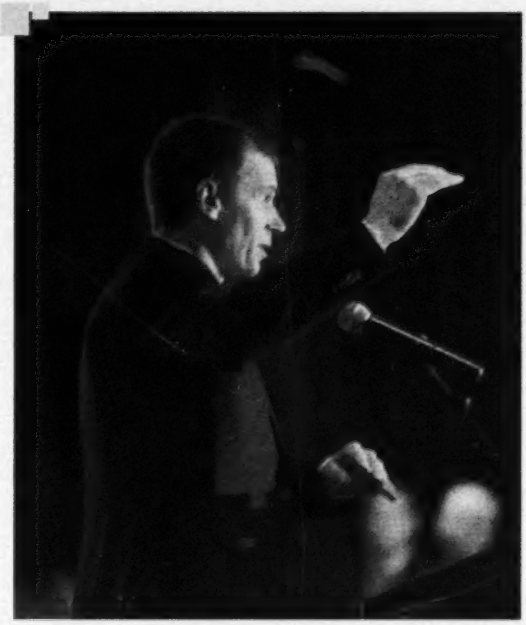
Dr. Marlo Raynolds discussed options for renewable energy in the NWT. He suggested that solar can be a viable option because it is scalable—meaning it can be used on a single building or as an array of hundreds of solar panels. However, he also emphasized that in the near-term, solar is not going to be a solution for year-round power. This means that diesel systems will still need to be in place until storage systems can become more efficient in terms of capacity and cost. Dr. Raynolds also recommends that a portfolio approach be used in the Northwest Territories energy planning—meaning hybrid systems that use some combination of solar, wind, battery, and diesel. In describing the NWT, Dr. Raynolds said it is the "most complicated 68 megawatts I've ever encountered."

"Status Quo Is Not an Option"

Several speakers emphasized that continued reliance on imported diesel for electrical generation and heating for many NWT communities is not sustainable in the long term. Rising energy costs, environmental concerns, and rapid changes in technology are all factors that are exerting pressure on the status quo. Although hydro-electricity is environmentally sustainable, continuing escalation in cost is not sustainable from an affordability perspective.

If the application of new technologies brings significant changes to the NWT's energy systems, as Minister Miltenberger pointed out, this will also exert pressure on the structure, ownership, regulation and subsidization of the NWT's electricity and heating markets. The GNWT energy policy framework needs to be designed to address these challenges.

There was also discussion about the need to ensure GNWT energy policy is better aligned with clearly defined objectives. There was agreement that this was important and it was noted that an amalgamation of various energy-related responsibilities into one department that is currently underway would improve alignment and coordination.



"The Northwest Territories is the most challenging 68MW I've ever encountered."

-Marlo Raynolds, PhD,
Vice President of BluEarth Renewables Inc.

Some of the other key points that presenters made are summarized below.

Economics of Energy in the NWT

Several presenters spoke about different aspects of the economics of energy systems and options in the NWT. The main points are provided below by market type:

Electricity

- In the thermal communities (those with diesel generators), approximately 47% of the cost to generate power is due to the cost of fuel. Diesel costs work out to about $0.32/kWh. If a renewable energy option is added to the local diesel grid, it must be able to provide power at less than $0.32/kWh in order to reduce the overall cost of electricity in diesel communities.
- The fuel cost for liquefied natural gas (LNG - used in Inuvik) is currently 20% less than the cost of diesel and, as supply chains become further developed, there is the potential for this cost to reduce further.
- As Dr. Marlo Raynolds pointed out in a media interview, if a remote community was installing base load electricity generation today, diesel would most likely be installed to provide the base load as well as reliable back-up power. Options such as solar, wind, and biomass combined heat and power are becoming cost competitive and need to be developed to reduce the use of diesel as much as possible.
- Without the benefit of interconnected transmission grids, the ability to use renewable energy technologies in thermal communities is somewhat limited (i.e. 20% - 30% penetration levels). Adding battery storage can double the amount of renewable capacity in a community, but this increases capital costs and impacts affordability.
- In hydro communities, the energy mix is typically about 95% hydro and 5% diesel. These are largely fixed-cost systems that provide wholesale power that is relatively inexpensive – about $0.10/kWh in the South Slave region and $0.18/kWh in the North Slave region. The fixed-cost nature of hydro communities was demonstrated in an analysis that reflected a 10% reduction in NTPC staffing costs would equate to about a 0.8 % reduction in the retail price in Yellowknife.
- There is currently an abundance of surplus hydro power in the South Slave (5 to 8 megawatts) and there are potential uses for it. In the North Slave, the use of large-scale

"The cost of capital is the largest component in hydro community rates – about 40% in Yellowknife. The cost of fuel is the largest component in thermal communities – about 47%."

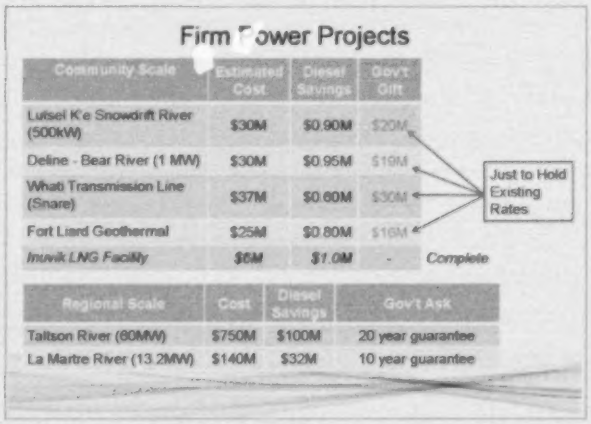
- Andrew McLaren, Intergroup Consultants

batteries, wind or solar systems or LNG (as a bi-fuel option) may be viable to help avoid diesel generation and assist in managing water reservoirs in the Snare hydro system during low water years.

- Extensions of the existing transmission grids or establishing an interconnection between the Taltson and Snare grids appears to be cost-prohibitive unless significant new industrial projects can be connected to help cover the costs.

Heating

While the NWT has made significant improvements in recent years in the use of biomass heating systems (to replace fuel-fired systems), heating is still a very substantial component of residents, businesses and government annual energy costs – the NWT heating market is estimated to be $150 million annually.



NWT Power Project Options, NT Energy

- The GNWT has stimulated the development of a new biomass heating industry in the NWT through converting large GNWT facilities from fuel oil to biomass heating.
- The NWT is leading the country in the installation of commercial-scale biomass heating systems. Biomass heating can provide energy costs savings of 25% or higher compared to fuel oil-heating systems, and can be used in residential, commercial and institutional buildings.
- A number of presenters emphasized that there is substantial opportunity to build upon the success and increase the use of biomass in the NWT. The use of biomass in combined heat and power (CHP) systems and/or district energy systems is an area with significant potential that the NWT should pursue.
- Given the NWT's large forest resources, it was stressed that the NWT should not be importing wood pellets from British Columbia and Alberta – it should be working to develop or expand its local biomass supplies (cordwood, wood chips, and pellets) and making use of fire-killed trees.

"The shift to biomass in GNWT buildings has helped support a growing biomass market and business opportunities in several NWT communities."

- Mike Burns, Assistant Deputy Minister of GNWT Public Works and Services

Transportation

Transportation was briefly discussed by some presenters. It was noted that a long term transformation in the transportation sector – through electric vehicles for example – would be challenging with high electricity rates (although there is currently an electric vehicle demonstration project currently being undertaken by the Arctic Energy Alliance).

Energy Conservation and Efficiency

Similar to the 2012 Charrette, a number of presenters emphasized the need to invest in more aggressive energy efficiency and conservation efforts. While energy efficiency makes sense for all communities (i.e. regardless of the type of energy being consumed), it was noted that there should be a concerted focus on improving energy efficiency in the thermal communities, as a means of helping customers lower their energy usage and monthly energy bills.

In making these comments, the presenters were not critical of the energy efficiency efforts already underway. Instead, the general sentiment was that more could be done to manage energy usage in existing homes and buildings and for new construction.

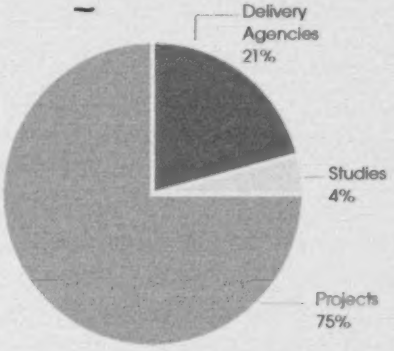
Energy Action Plan

The table and pie chart below provide a breakdown of the budget and funding allocations for the current NWT Energy Action Plan:

Energy Action Plan Budget: 2013-14 to 2015-16

BUDGET	2013-14	2014-15	2015-16	Total
Total Investments	$8.9 M	$12.0 M	$10.6 M	$31.5 M
New Investments	$6.4M	$9.4M	$8.0 M	$23.8M

Total Investments in the table above reflects all of the funding the GNWT invests in energy, including ongoing funding for operations, staff and energy conservation and efficiency program base funding, including the Arctic Energy Alliance. New Investments represents funding for projects as well as retrofits for GNWT assets.



Some of the key activities funded in the $31 million figure above include:

- $7.4 million for energy efficiency program delivery over three years;
- $8.8 million for strategic biomass investments (as part of the NWT Biomass Energy Strategy) over three years; and
- $1.6 million for solar energy (as part of the NWT Solar Energy Strategy) over three years.

3.2. Group Session Results

During the afternoon of the Stakeholder Session, participants were organized into seven groups, each led by a facilitator. The purpose of the group session was to enable participants to discuss what they had heard so far during the Charrette and identify specific suggestions to the GNWT regarding energy planning objectives, as well as short and long-term actions to pursue.

Anouk Kendall, Decentralized Energy

3.2.1. Energy Planning Objectives

During the 2012 Energy Charrette, participants were asked to discuss and rank energy objectives that the GNWT should consider when planning energy initiatives and making energy investment decisions. Building on this work, six overarching energy objectives were included in the NWT Energy Action Plan (see pages 13-14).

Earlier this year, the GNWT enlisted the help of consultants and members of an interdepartmental Energy Working Committee (EWC) to identify performance measures for energy planning that could be used to inform and evaluate the GNWT's energy investment decision-making process. This work resulted in a more refined set of suggested objectives and sub-objectives to guide GNWT energy planning (in no particular order), as follows:

1. Improve energy affordability
    a. Minimize community energy expenditures
    b. Minimize GNWT operating costs for government assets
    c. Reduce the requirement for energy subsidization

2. Minimize environmental impacts of energy production and consumption
    a. Minimize GHG emissions from energy use and production
    b. Minimize the environmental footprint of energy use and production (e.g. fuel spills, noise, air pollution)

3. Improve energy-related economic benefits
    a. Maximize the potential to keep economic benefits associated with energy development and production in the NWT

4. Improve energy security
    a. Improve electricity system reliability for all consumers
    b. Reduce community vulnerability to future price escalations and/or supply shortages

This work was summarized in a table format (Objectives, Sub-Objectives and Performance Measures) and provided to the Charrette Groups for their review, comments and ranking. This table can be found in Appendix C.

Comments & Suggested Revisions

There were a few suggestions on how the objectives might be revised or improved. These included:

Health:

- Ensure that the concept of "energy affordability" includes life-cycle costs, which in turn should include human health costs
- Expand the definition of "environment" to include "human and environmental health" and to better reflect the impact that things like air pollution can have on human health

Community Benefits:

- Community or social benefits, or community well-being should be added as an objective

There was also a suggestion that the GNWT may need to develop a tool or evaluation template to help balance different priorities and objectives when considering energy investments.

In general, the participants expressed strong support for the objectives and sub-objectives as drafted.

Ranking of Objectives

The groups were asked to indicate which of the energy planning objectives they felt were most important. In response, there was a general sentiment that all the objectives were important, and that investments in energy projects or initiatives should strive to satisfy as many objectives as possible.

Overall, "Affordability" was considered the most important objective – five groups (out of seven) ranked it first.

The other three objectives "Environment", "Economy" and "Energy security" were ranked fairly closely together, being second, third and fourth in roughly the same number of groups.

One group added a fifth objective "Social resilience/benefits" and ranked it as tied for second with "Affordability" in their scoring.

It should also be noted that the results described above are based on the input from six of the seven groups. One group was not comfortable with voting on the objectives as they felt all the objectives are connected and important, and that energy projects should cover all the objectives, rather than only one or two.

The clear message was that the majority of participants felt that the primary objective should be affordability.

3.2.2. GNWT Approach to Energy Systems

Groups also discussed the GNWT's general approach to energy. With a limited budget to spend on energy, the basic question was whether the GNWT should try to focus on large-scale energy projects or smaller, community-scale projects, or a mix of both?

The groups were not asked to rank them, rather each group was asked to provide reasons for the view(s) they put forward. Five of the groups addressed this question as two others ran out of time. The responses are generally organized into three main points:

Large-scale projects

There was recognition that some of the legacy infrastructure that the NWT enjoys today (such as hydro-electric plants) are the result of historical mining projects and would not exist otherwise. That said, there was also a sense that the GNWT has focused quite heavily in recent years on large energy projects that were potential "game-changers" but did not come to fruition (for a variety of reasons). There seemed to be a general consensus that a move towards smaller, community-scale projects may be the best direction for the GNWT to take.

Smaller, community-scale projects

Several groups expressed general support for a community-scale approach to energy investments. There was recognition that communities are interested in owning their projects and realizing economic benefits. There was a clear suggestion that the focus under this approach should be on the small, thermal communities which rely on imported fuel and have the highest energy costs.

Several groups also provided specific comments on how the GNWT should implement community-scale energy projects, including:

- Making changes to energy policy to support independent power production, including examination of creative ownership models; and
- Providing support to build local capacity (planning, financial, training etc.).

"Portfolio Approach"

Echoing comments from Dr. Raynolds discussed above, a few groups suggested that a balanced, portfolio approach was most appropriate. This approach would include continued, but limited, work on large-scale projects, while maintaining a focus on community-scale projects. Community-scale projects should consider a mix of fuel sources and technologies, and those that provide the "best bang for the buck". It was also emphasized that if large or regional projects are contemplated, they should only proceed if there is local support and local benefits.

In general, there was support for integrating renewable fuel sources into local diesel-electric grids (a hybrid power production model) but it was also recognized that the GNWT should consider larger projects if viable opportunities come along.

3.3. Short and Long Term Actions

Early in the preparations for the 2014 Charrette, Premier McLeod posed the following three questions:

1) Is there more that the GNWT can do in the short term to help NWT residents and businesses cope with rising costs?
2) Considering the energy programs and projects currently identified in the Energy Plan, are there other actions or programs the GNWT should consider?
3) What should be the approach to transforming our energy systems to ensure they are affordable and sustainable in the long term?

It should be noted that due to time constraints, there was very little focus on question (2) which was interpreted as a request for a critique of the current Energy Action Plan to identify what was missing. There was a general consensus that the Energy Plan hits most of the key areas, but that in light of the presentations and discussions at the Charrette, there is more the GNWT can do in both the short term and in the long term. As such, the discussion below incorporates many of the recommendations provided through the Energy Charrette discussions and the group work discussed above.

A number of the actions below, such as energy efficiency, can be completed in the short term. Other actions involve studies and analysis in the short term to set the stage for action in the mid to longterm, such as finding a use for the surplus of hydro power in the Taltson hydro system.

3.3.1. Summary of Short-Term Actions

For the purposes of the Charrette, short-term actions were defined as being "implementable" in a few months. As such, these are actions that could be added to the third year of the Energy Action Plan (i.e. for fiscal year 2015-16).

Actions suggested by a number of different groups included:

1) Be More Aggressive on Energy Efficiency and Conservation

- Complete a discussion paper on an NWT Energy Efficiency Act – committed to in the Energy Plan. This should consider implementation of energy efficiency standards or regulations (building envelope, appliances and products).
- Focus immediate efforts on hydro communities served by the Snare hydro grid to minimize additional diesel generation due to low water conditions.
- Increased promotional and information campaigns. A greater focus is required on providing communities and residents with energy information and enhancing 'energy literacy'.
- Particular focus on program delivery / support in the thermal communities. Ideas included replacing incandescent lighting and replacing electric hot water heaters.

2) Find Ways to Make Use of the Excess Electrical Energy at the Taltson Hydro Facility

- The cost of upgrades and potential uses would require some study – this analysis should be implemented in the short term.
- Obvious uses include electric heating and electric vehicles in the South Slave region.
- The GNWT could consider issuing a Request For Proposals (RFP) to see what ideas the private sector may have.

"Energy efficiency and conservation are always the easiest short term opportunities."

-Ernie Campbell, Deputy Minister, Environment and Natural Resources

3) Continue to Build on Biomass Energy Initiatives in the Short Term

- Implement a policy to support harvesting of fire killed trees.
- Develop plans to further expand regional / community biomass supply and distribution channels.
- Develop a biomass combined heat and power project – there was a great deal of discussion on this technology at the Charrette.
- Increase financial support for the installation of residential biomass heating (wood or pellet stoves).
- Address existing regulatory barriers to the installation of biomass heating systems (some felt that the existing regulations related to biomass installation are out of date);
- Provide enhanced financial support and/or technical support for the installation of biomass heating systems in the thermal communities.

4) Plan for Increased Development of Small-scale Renewable Energy Projects

- The Charrette participants heard a great deal from presenters discussing the rapidly reducing costs of solar.
- The focus was mainly on the thermal communities, and several groups mentioned enhancing the focus on solar technologies. Other technologies should be considered as well.
- Issue an exploratory RFP to gauge the level and type of private sector interest (the results may help identify partners for the project ideas described above or result in new ideas).

5) Examine the Potential Benefits of Increased Private Sector / Community Involvement and Investment in Energy

- During the Charrette, there were several suggestions about increasing the involvement of the private sector and developing creative project financing mechanisms that would provide opportunities for community governments, Aboriginal development corporations and residents to participate in the ownership of local and/or regional energy projects. These ideas were not discussed in much detail, however, and it is suggested that the GNWT investigate these matters further.

6) Other Suggestions

- Establish a clear policy on net metering and independent power producers.
- Provide improved training opportunities for people in smaller and more isolated communities to service and repair infrastructure.
- Formalize a relationship with the Canadian High Arctic Research Station (CHARS) (located in Cambridge Bay, NU) as a partner in research and development of northern-specific energy technologies.
- If major structural changes for the electricity sector are to be contemplated, a comprehensive study on options, potential benefits, and limitations would be required for the consideration of the 18th Legislative Assembly.

3.3.2. Summary of Longer-Term Actions

For the purposes of the Charrette, the longer term was defined as actions that could be considered by the 18th Legislative Assembly and implemented in the next 2-5 years.

Andrew Robinson, Consultant

Due to time limitations, some groups did not provide as many suggestions on longer-term actions and focused only on a few ideas. Certainly, most of these suggestions are not new to the NWT. In particular, many of the energy supply technologies have been either studied and/or implemented in some fashion, including small hydro, transmission lines, natural gas, LNG, biomass (for heating) and solar-diesel.

As well, in the absence of knowing how much capital funding the GNWT has available to allocate to energy projects, it was difficult for the participants to determine priority projects or investments to recommend.

Actions that garnered support among different groups included:

Energy Efficiency

- Implement an NWT Energy Efficiency Act (if not addressed in the short-term)
- Continue to be aggressive in pursuing various energy efficiency actions and initiatives

Energy Supply

- Continue to consider small hydro and/or transmission line build-out (where feasible)
- Improve the utilization of waste heat recovery technologies (in larger communities where there are economies of scale)
- Develop biomass combined heat and power (CHP) systems
- Develop district energy systems (using waste heat recovery and biomass CHP)
- Develop natural gas (in the Beaufort Delta region) and/or LNG where feasible
- Focus on small scale solar and biomass projects (for thermal communities)
- Examine potential for using waste to produce energy (in larger communities where there are economies of scale)
- Develop new markets for Taltson hydro (for heat and charging electric vehicles)

Policy

- Set medium and long term targets for the NWT's use of local and renewable energy sources
- Power Purchase Agreements issued by utilities, feed-in-tariffs and renewable portfolio standards for industry are all mechanisms that could support a large-scale shift to increased use of local and renewable sources as well as enable the private sector to become more involved in NWT energy supply
- Legislated energy efficiency standards and/or programs
- Deployment of smart grid technology

Other Suggestions

- Develop an Energy Heritage Fund
- Mandate renewable energy projects for mining projects – through a renewable portfolio standard, to support the development of legacy projects for the NWT
- Implement time of use pricing and metering for electricity
- It was suggested that the GNWT consider using technical and community-level advisory committees to enable people to continue to work on energy actions in a collaborative fashion – i.e. a process that can be used between Energy Charrettes
- The development of clear and detailed project criteria would allow the private sector to bid on projects or consider investing in NWT energy projects. A clear framework for project implementation is needed that reduces risk and improves the rate of return on projects

Dwayne Wohlgemuth, Ko Energy

4. THE APPROACH TO TRANSFORMING OUR ENERGY SYSTEMS

This section was developed by the Charrette facilitators and is focused on the approach going forward and builds up the comments in section 3 above. In short, it is about bringing rigour to the process – ensuring objectives are clear, alternatives are considered and trade-offs are quantified.

The GNWT approach to energy planning can be organized into two related approaches:

1) Planning guided by clearly defined objectives and priorities; and
2) A "portfolio" approach that uses multiple scales (community vs. regional vs. territorial, and thermal vs. hydro zones) and multiple energy sources and technologies.

4.1. Use Objectives-Focused Decision-Making

Charrette participants expressed interest in seeing the GNWT make energy-related decisions based on clear objectives and priorities. While this is fairly straight-forward to state, implementing such an approach can be challenging as there are usually trade-offs. For example, Charrette participants felt that affordability was the most important energy concern, followed closely by concerns about the environment, local economic benefits and system reliability. However, while many presenters made the case that renewable energy sources are rapidly decreasing in price, experience in recent years has shown that additional 'renewable' infrastructure for electricity generation (solar, for example) adds costs to the system. The GNWT has usually subsidized these investments to address both the affordability and environmental objectives, but without government funding, often there is a trade-off to be made. The installation of biomass boilers hasn't required subsidies, a case where all of the objectives can be reasonably achieved.

To properly use these energy objectives in planning and evaluating future energy projects, the GNWT will need to complete additional work to "operationalize" the objectives. This means that energy programs, projects and policies are designed around meeting the clearly defined objectives.

"The key to good policy is having objectives that are:
• measureable
• longer-term, yet adaptable
• simple and transparent"

-Marlo Raynolds, PhD,
Vice President of BluEarth Renewables Inc.

Key steps to be completed include:

- Review Current Energy Planning Objectives
- Further Develop Performance Measurement Criteria
- Evaluate Potential Actions
- Select Actions Based on Objectives
- Improve Energy Tracking and Reporting

These steps are discussed in greater detail in Appendix C.

4.2. Take a Portfolio Approach: Multiple Scales, Energy Sources and Technologies

At both the 2012 and 2014 Energy Charrettes, there was widespread recognition among energy experts and NWT residents that there is no "silver bullet" in terms of one technology or energy source or scale of project that can meet all relevant energy objectives, such as affordability, protecting the environment, ensuring system reliability and local economic benefits (although biomass comes close). Therefore, the portfolio approach recognizes three key variables:

a) Thermal Zone Impacts vs. Hydro Zone Impacts

b) Regional Opportunities and Constraints

c) Multiple Sources of Energy and Technologies

Thermal Zone Impacts vs. Hydro Zone Impacts

Some initiatives are going to have a far greater impact in terms of achieving the objectives depending upon whether they are focused in the thermal zone or the hydro zone. Charrette participants emphasized the need to reduce energy costs to thermal zone communities in particular. However, when it comes to affordability, greater efforts to reduce energy use in all residential units, businesses, community buildings and GNWT facilities is required. That said, the greatest opportunity to reduce the system costs and environmental impacts of diesel resides in the thermal communities. The long term goal should be to minimize actual diesel fuel consumption as much as possible.

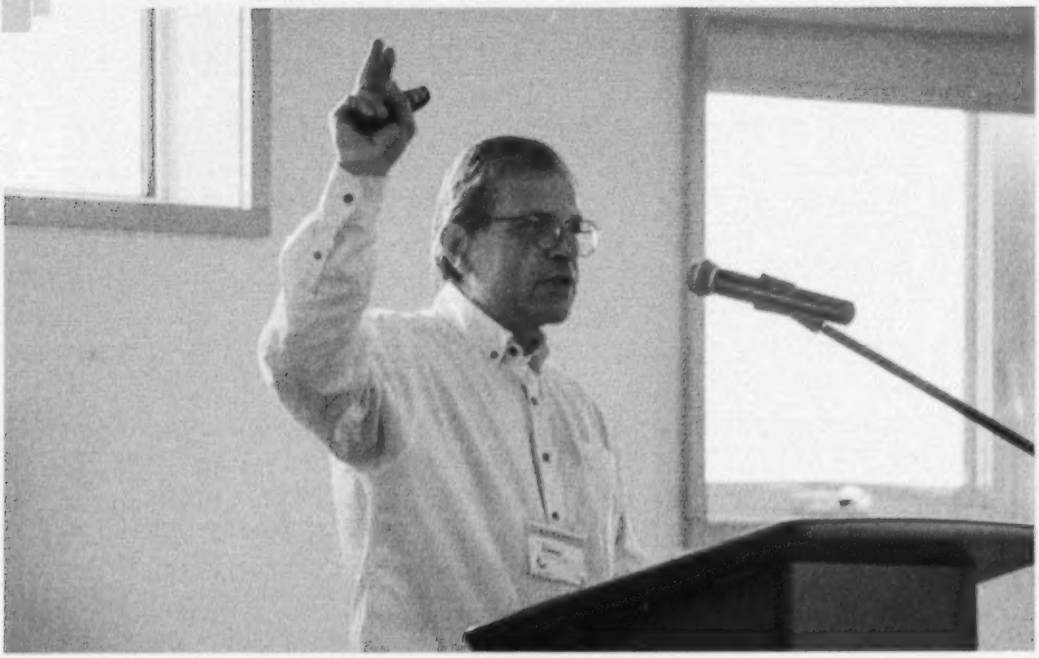
Regional Opportunities and Constraints

Charrette participants also noted that each community or region has its own specific needs, including where energy resources are located, the location and size of community and/or industrial loads, and other regional factors such as climate, transportation systems, land-use plans and regulatory agencies.

There may be merit in identifying, evaluating and implementing energy projects through community or regional energy plans. As several Charrette participants suggested, this could be done via participatory stakeholder engagement processes like a Charrette at the regional or community level.

Multiple Sources of Energy and Technologies

Charrette presenters and participants emphasized the importance of drawing upon a range of energy sources in the NWT. While the consensus is to reduce diesel use, as many energy experts pointed out, diesel will still be needed as a fuel source. However, many other fuels and distribution technologies are becoming increasingly cost effective, and technologies are proving to be viable for the northern climate. Therefore, the GNWT should continue to examine and consider the feasibility of several different energy types including small hydro, natural gas / LNG, biomass CHP and extensions of existing transmission lines. It is suggested that this work be organized in the context of energy planning objectives discussed above.



Louie Azzolini, Executive Director, Arctic Energy Alliance

5. CONCLUSION AND NEXT STEPS

The NWT has some complex challenges in providing affordable and sustainable energy to 33 remote communities spread over a vast distance. The purpose of the Energy Charrette was to bring together community representatives, Aboriginal government representatives, government, and energy experts to discuss the way forward. This Report has attempted to capture those discussions and ideas for the GNWT to consider as plans are developed for the future.

As noted earlier, this Report has been prepared by the Charrette facilitators and is not considered to be a GNWT document.

It is understood that once the Charrette Report has been released, the GNWT's next steps and timeline will include:

January 2015 – an advertising campaign to make Charrette participants and the general public aware of the Report and to solicit additional public input on the contents of the Report and energy issues in general;

February 2015 – the GNWT will prepare and release a response to the Charrette Report;

March – May 2015 – the GNWT will release a Response that could reflect new energy initiatives and/or a re-allocation of financial resources for 2015/2016.

Appendix A – Charrette Agenda

NOVEMBER 3rd PUBLIC KICK-OFF EVENT 7:00 – 9:00 PM

7:00 Overview of the Charrette

Rob Marshall will provide a brief introduction to the events.

7:05 Welcome and Blessing from Yellowknives Dene First Nation

7:10 Addressing Our Energy Challenges: Premier Bob McLeod

Premier McLeod will discuss some of the challenges currently facing the Northwest Territories and outline what the GNWT hopes to accomplish though the 2014 NWT Energy Charrette.

7:20 Energy Solutions for Communities: Minister Michael Miltenberger

Minister Miltenberger will discuss the need for the NWT to continue to move away from imported diesel. Local and renewable solutions such as hydro, biomass, solar, wind, and geothermal could all have a role to play in our diverse territory. The use of liquefied natural gas could be one of the solutions in the interim.

7:30 Alternative and Renewable Energy Solutions:

Mr. Marlo Raynolds, PhD., Vice President, BluEarth Renewables

With over 15 years of experience in the energy sector, Marlo is responsible for evaluating, improving and expanding BluEarth's markets in renewable energy. Prior to joining BluEarth, Marlo was Executive Director at the Pembina Institute, a nationally-recognized energy think-tank, for seven years. He holds a Bachelor of Science in Systems Design Engineering from the University of Waterloo; a Masters in Management and Leadership from McGill University; and a PhD in Mechanical Engineering from the University of Alberta. Marlo is also an Adjunct Assistant Professor of Sustainable Development at the Haskayne School of Business, University of Calgary and was recognized as one of Canada's Top 40 Under 40 in 2008.

Marlo will provide an overview of emerging and proven technologies that can be applied in the north and discuss the approach and some of the milestones on the pathway towards a sustainable energy future for northern communities.

8:00 Discussion: Where We Are Today

Ernie Campbell, Deputy Minister of Environment and Natural Resources, GNWT

Gordon Van Tighem, Chair, Public Utilities Board

Emanuel DaRosa, President and CEO, NT Hydro

Dwight Redden, General Manager, Northlands Utilities

Moderator: Mark Cleveland

Mark Cleveland will moderate this panel discussion. Mr. Cleveland lead the GNWT Electricity Review in 2009 and has a thorough understanding of NWT electricity system issues.

Panelists will provide some brief opening remarks and the floor will be opened for questions. This session is proposed to be interactive and audience participation will be encouraged. The panel represents a range of expertise and experience in NWT energy issues. The objective is to hear public perspectives so they can be considered during the following day's deliberations.

The discussion will include the three questions that the Premier has posed:

1) Is there more that the Government of the Northwest Territories can do in the short term to help Northwest Territories residents and businesses cope with rising costs?
2) Considering the energy programs and projects currently identified in the Energy Plan, are there other actions or programs the GNWT should consider?
3) What should be the approach to transforming our energy systems to ensure they are affordable and sustainable in the long term?

NOVEMBER 4th KEY STAKEHOLDER'S SESSION *(Invitation Only)* – Chief Drygeese Centre, Dettah

7:45 Bus departs Explorer Hotel, Delegates travel to the Chief Drygeese Centre in Dettah.

8:15–8:30 Coffee, continental breakfast available

8:30–8:45 Welcome and Introductory Remarks: Rob Marshall

Rob will provide a review of the discussion held the previous evening, provide an overview of the day ahead and discuss the process and outcomes in relation to the three questions posed by Premier McLeod. The morning session is designed to hear and discuss a variety of views, including those of experts from other jurisdictions.

8:45–9:15 Andrew McLaren, Intergroup Consultants

Presentation: Economics of Energy in the NWT

In order to set the context for identifying energy solutions, Andrew will provide an overview of the economics of hydro, diesel, natural gas, biomass, solar, wind, and geothermal energy sources in the NWT.

9:15–10:30 Panel Discussion: Long Term Energy Options for the NWT

Moderator: Dennis Bevington, MP, Northwest Territories
Andrew Stewart, Director, Business Development, NT Energy Corporation
Mario Raynolds, PhD., Vice President, BluEarth Renewables
Anouk Kendall, President, Decentralized Energy Canada (DEC)
Axel Lambion, Managing Director, Lambion Energy Solutions
This panel picks up from the public discussion the previous evening. Options to transform our energy systems in the long term need to continue to be explored. Dennis Bevington will moderate this panel composed of 'outside experts'.

Topics to be addressed include perspectives on emerging trends in alternative and renewable energy technologies and cost, and policy considerations for governments. The panel will also touch upon 'big solutions' versus local community-based solutions.

10:30–10:45 Break

10:45–11:30 Panel Discussion: Northern Experience with Local, Renewable and Alternative Energy Solutions

Meaghan Bennett, Manager, Canadian High Arctic Research Station
Myra Berrub, Manager Energy Services,
Northwest Territories Power Corporation
Liezl Van Wyk, Manager Operational Excellence, Diavik Diamond Mine Inc.
Bruce Elliott, Arctic Green Energy

Meaghan Bennett will begin with an overview of the ground-breaking work being undertaken in the design and construction of the Canadian High Arctic Research Station. Myra Berrub will discuss GNWT and NTPC experience with renewable energy projects. Liezl Van Wyk will discuss Diavik's experience with emerging technologies and Bruce Elliot will discuss the potential for the increased use of Biomass in the north.

11:30–12:15 Panel Discussion: Overview of the Energy Plan and a Focus on Energy Conservation and Efficiency

Dave Nightingale, Director, Energy Policy and Planning, GNWT

Louie Azzolini, Executive Director, Arctic Energy Alliance, GNWT

Mike Burns, ADM, Public Works and Services, GNWT

Jim Sparling, Manager of Climate Change Programs, GNWT

Dave Nightingale will provide an overview of the energy plan, Louie Azzolini, Mike Burns and Jim Sparling will provide the latest information regarding their efforts in the area of energy conservation and efficiency.

12:15–1:00 Lunch on Site

1:00–1:15 Rob Marshall: Recap of the Morning Discussion, Setting the Context for the Group Work

1:15–3:00 Facilitated Group Sessions

Charrette participants will be split into groups, each lead by a facilitator. Each group will address one of the questions posed by the Premier and develop a presentation for the larger group to consider. Each presentation needs to consider the question from four perspectives:
Economics / Environment / Economy / Social

1) Is there more that the Government of the Northwest Territories can do in the short term to help Northwest Territories residents and businesses cope with rising costs?
2) Considering the energy programs and projects currently identified in the Energy Plan, are there other actions or programs the GNWT should consider?
3) What should be the approach to transforming our energy systems to ensure they are affordable and sustainable in the long term?

3:00–4:30 Report back results of the exercise, followed by a Large Group Facilitated Discussion

4:30 Wrap Up and Next Steps

Appendix B – 2014 Northwest Territories Energy Charrette Participants

Community Representatives and Participants

City of Yellowknife
Colville Lake
Fort McPherson
Hamlet of Ulukhaktok
Hay River
Norman Wells
Sambaa K'e First Nation
Town of Fort Smith
Town of Inuvik
Tracey's Plumbing and Heating
Tulita Yamoria Community Secretariat

Non-Government Organizations

Alternatives North
Ecology North
Mackenzie Valley Environmental Impact Review Board
NWT Association of Communities
Pembina Institute

NWT Governments, Agencies and Development Corporations

Deh Gah Gotie First Nations
Dehcho First Nations
Délînê Land Corporation
Denendeh Investments
Det'on Cho
Fort Norman Métis Land Corporation
Fort Providence Métis Council
Hay River Métis Council
Salt River First Nation
Tłı̨chǫ Investment Corporation
Whatì Community Government
Arctic Energy Alliance
Northwest Territories Power Corporation
NT Energy Corporation
NT Hydro
NWT Housing Corporation
NWT Public Utilities Board
Government of the Northwest Territories Departments

Industry Representatives

Arctic Green Energy
ATCO Group
Consulting Engineers of the NWT
Diavik Diamond Mines
Energy North
Flash Point Facilitators Ltd.
Northland Utilities (NWT) Ltd.
Northland Utilities (Yellowknife) Ltd.
NWT & Nunavut Chamber of Mines
NWT & Nunavut Construction Association
NWT and Nunavut Association of Professional Engineers and Geoscientists
NWT Chamber of Commerce
Polar Tech, Clean Energy Division
Wallbridge Law Office

Representation from Outside the NWT

AECOM
BluEarth Renewables Inc.
Canadian High Arctic Research Station
Carleton University
Decentralized Energy Canada
Government of Canada
Government of Nunavut
Government of Yukon
Intergroup Consultants
Lambion Energy Solutions
Nunatsiavut Government
Nunavut Utility Rates Review Council
Yukon College

Appendix C – Energy Objectives and Additional Discussion

The Energy Planning Objectives discussed and ranked at the Charrette are shown below:

OBJECTIVE	SUB-OBJECTIVE	MEASUREMENT
Affordability	Minimize community energy expenditures	*How does this help reduce community energy expenditures?*
		Who is the primary beneficiary? (residents/business/local government)
	Minimize GNWT operating costs	*How does this help reduce GNWT operating costs?*
	Reduce requirement for GNWT energy subsidies	*How does this help reduce the requirement for subsidies?*
Environment	Minimize the environmental footprint of energy use and production	*How does this help reduce greenhouse gas emissions?*
		How does this help reduce noise and air pollution, or the risk of fuel spills?
Economy	Keep economic benefits in the NWT	*How can this help keep economic benefits in the NWT? (via local labour, materials)*
Energy Security	Improve electricity system reliability	*How does this improve system reliability (reduced outages)?*
	Reduce community vulnerability to future price escalations	*How does this reduce imported, purchased energy?*
		How does this add to the diversity of energy supply?

To properly use these energy objectives in planning and evaluating future energy projects, the GNWT has begun additional work to "operationalize" the objectives. This means that energy programs, projects and policies are designed around meeting the clearly defined objectives.

Key steps that need to be completed include:

- Review Current Energy Planning Objectives – the results from the 2012 and 2014 Charrettes, as well as additional work done in recent months, provide a solid starting point. It is suggested that the wording of the objectives (and sub-objectives) be reviewed to ensure they fully reflect the GNWT's and stakeholders' goals with respect to energy, the economy and the environment;
- Further Develop Performance Measurement Criteria – the GNWT has completed preliminary efforts to develop performance measurement criteria (see following page). These criteria are used in two ways: 1) to predict performance as a way of choosing among energy actions and 2) to help assess how well ongoing projects and programs are performing. The GNWT needs to ensure there is a consensus that these are suitable criteria to use;
- Evaluate Potential Actions – it is suggested that the GNWT first ensure that its list of identified energy actions and alternatives is complete. The energy objectives and measurement criteria can be used to evaluate how well the potential actions may perform at meeting the various objectives;
- Select Actions Based on Objectives – the potential energy actions should be compared based on how well they perform at meeting the various objectives. The Energy Working Group has developed an evaluation template to help evaluate and compare different energy actions. The GNWT can utilize this template to help select the most effective energy actions to invest in. More sophisticated 'trade-off analysis' tools are also available to help guide this process; and
- Improve Energy Tracking and Reporting – clearly stated energy objectives and measurement criteria enable the GNWT to track and evaluate progress over time. Once the performance measurement metrics are established, sufficient resources will be needed to gather and analyze data and provide reports on results achieved.

The energy evaluation framework shown on the next page shows the work completed to date on the development of specific performance measurement criteria (see 3rd column).

ENERGY INITIATIVE EVALUATION FRAMEWORK

OBJECTIVE	SUB-OBJECTIVE	MEASURE
Affordability	Minimize community energy expenditures	*Project payback based on community savings*
		Lifetime community $ saved per $ invested
		Primary Beneficiary (residents/business/local government)
	Minimize GNWT operating costs for government assets	*Project payback based on GNWT savings*
	Reduce requirement for GNWT energy subsidies	*Lifetime GNWT $ saved per $ invested*
		Lifetime reduction in subsidy per $ invested
Environment	Minimize GHG emissions from energy use and production	*Lifetime GHG reduction*
	Minimize the environmental footprint of energy use and production	*$ invested per tonne of lifetime GHG reductions*
		How does this investment reduce the risk of fuel spills, reduce noise in the community or reduce air pollution?
Economy	Keep economic benefits in the NWT	*NWT impact in $ per total $ invested (includes local labour, materials)*
Energy Security	Improve electricity system reliability	*How does the investment improve system reliability?*
	Reduce community vulnerability to future price escalations.	*Reduction in imported, purchased energy per $ invested (MJ/$)*
		How does the investment add to diversity in community energy mix?

For comments, please submit to:

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